5.16.36 DENSITY OF FRESH CONCRETE IN BRIDGE DECK OVERLAYS BY NUCLEAR GAUGE (Kansas Test Method KT-36)

a. SCOPE

This method of test covers the procedure for determining the in-place density of fresh concrete in bridge deck overlays using a nuclear density gauge. This method is applicable to all types of concrete. **Gauge calibration shall follow 5.21.02 INDEPENDENT ASSURANCE REPLICATE (ASR) CHECK FOR NUCLEAR DENSITY GAUGES.** KDOT gauges shall be calibrated at the Materials and Research Center.

The equipment utilizes radioactive materials which may be hazardous to the health of users unless proper precautions are taken. (For KDOT field personnel only: Refer to Standard Operating Manual No. 1.13.2.)

b. REFERENCED DOCUMENTS

b.1 KT-20; Weight per Cubic Meter (Foot), Yield Cement Factor and Air Content (Gravimetric) of Fresh Concrete

c. APPARATUS

c.1. Nuclear density gauge with supporting equipment including reference standard, survey meter, and instructional material.

c.2. Frame to hold gauge at the concrete surface both on the box and on the in-place material.

c.3. Shovel, trowels, wash bucket, tire brush, rags.

c.4. Tape measure,

c.5. Pachometer.

c.4. Depth Gauging Wire.

c.6. A supply of 600 µm (No. 30) sand screened from the fine aggregate in the mix or a pan and a 600 µm (No. 30) sieve.

c.7. Brush for cleaning up sand.

d. DAILY WARM UP AND CHECK

The nuclear gauge shall be turned on for warm-up and checked according to the Manufacturer's instructions.

e. DENSITY READINGS OF THE EXISTING BRIDGE DECK

Readings should be taken in a random manner unless there are sound reasons to relocate. Readings should not be taken closer than 0.3 m (1 ft) to a vertical surface.

e.1. Direct Transmission Readings.

Place the gauge on the surface and depress the probe to the appropriate depth, when exceeding 50 mm (2 in). On very stiff mixes, it may be necessary to make a hole in the fresh concrete with the 15 mm (5/8 in) graduated pin and hole-forming device furnished with the gauge. The alignment of the hole and the probe is greatly facilitated if the gauge is placed on the concrete surface first. The probe location will show on the fresh concrete as will the outline of the gauge.

e.2. Backscatter Readings.

Backscatter readings are required on overlays less than 50 mm (2 in) thick.

In addition, the effect of the underlying layer on the readings need to be taken into account. This is done as follows:

e.2.a. Obtain a supply of minus 600 µm (No. 30) sand.

e.2.b. Mark the location of the top reinforcing steel using a pachometer in at least three relatively smooth areas.

e.2.c. Place some sand in the area between the reinforcing steel and screed off the excess using a rule or other straight edge. The area covered by the sand should be slightly larger than the bottom of the nuclear gauge and should have all the surface voids filled with the fine sand. There should only be enough sand to fill the voids. Excessive quantities can be counter productive.

e.2.d. Place the gauge on the prepared area, lower the probe to the backscatter position, take 3 one-minute readings and average.

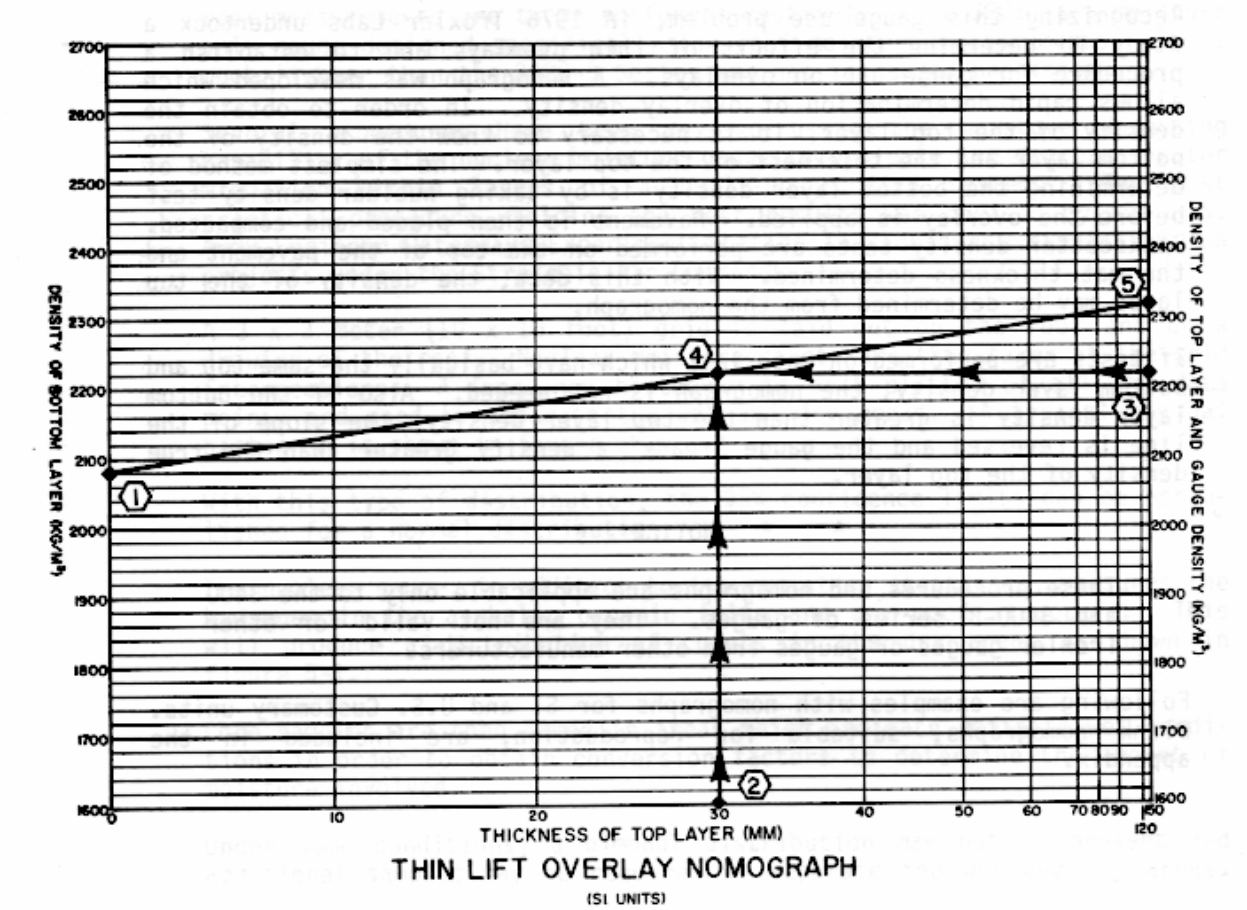
e.2.e. Repeat in at least two other locations. Average all of these for an average density of the underlying layer. Low readings originating from an air gap under the gauge should not be included in the average.

e.2.f. The nuclear readings on the overlay are corrected by using the nomograph and the procedure in the manufacturer's manual, as follows:

****NOTICE****

This procedure and nomograph are applicable only to the 3400 series gauge. It is not valid for other Troxler gauges or gauges from other manufacturers. The Troxler 3440 gauge contains software which can make the corrections described above within itself. Refer to operators manual.

IN SI UNITS:

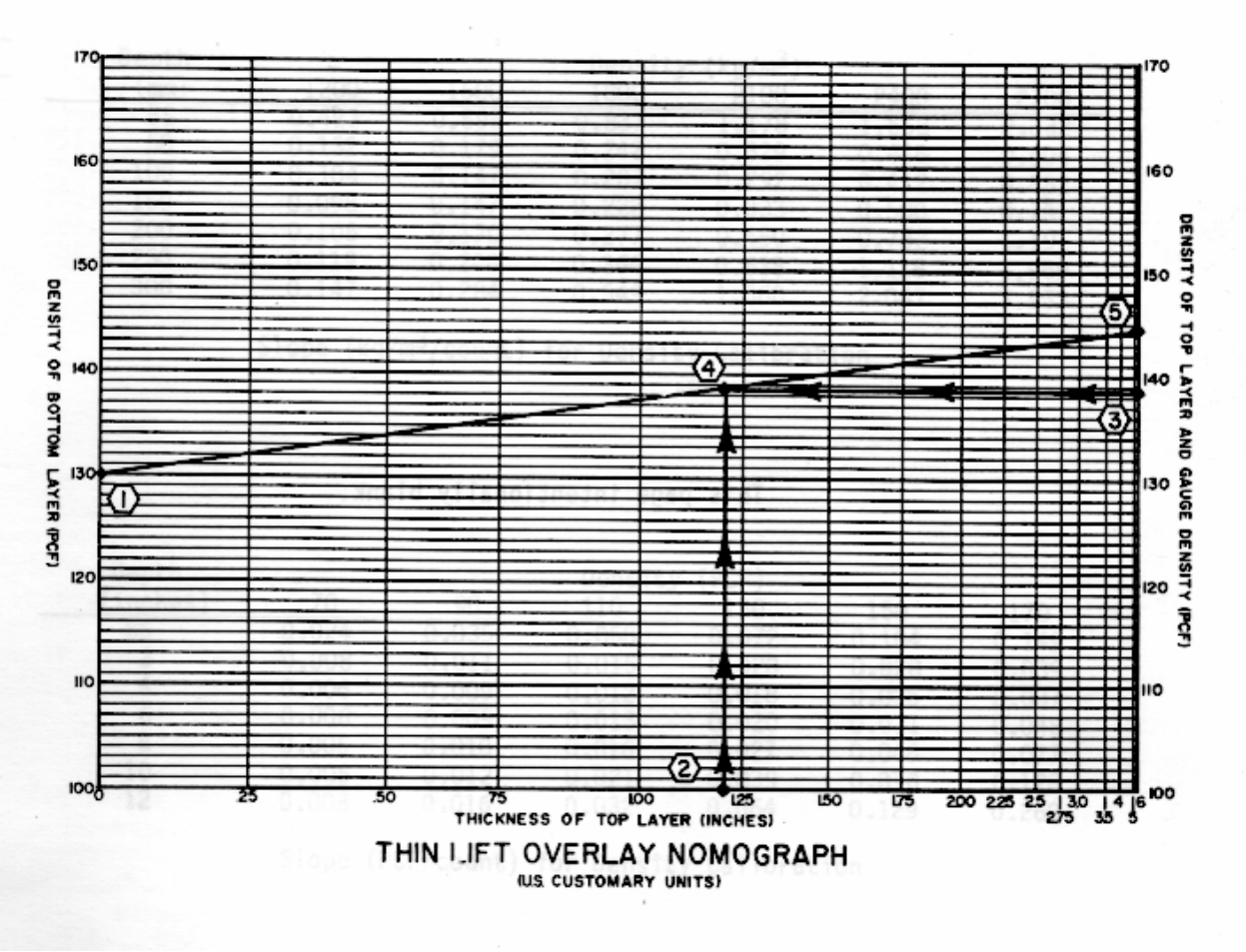


THIN LIFT OVERLAY NOMOGRAPH

(SI UNITS)

In this example, the bottom layer density (left scale) is 2080 kg/m^3 with a mat of 30 mm thick overlaying it. A backscatter density test on the top of the mat (right scale) yielded a result of 2220 kg/m^3. A line is then drawn from 2080 kg/m^3 on the left scale through the intersection of 30 mm (bottom) and 2220 kg/m^3 (right) and extended to the right. The correct density for the top layer is then read from the nomograph as 2320 kg/m^3 on the right scale.

IN ENGLISH UNITS:



In this example, the bottom layer density (left scale) is 130 PCF with a mat of 1.2 inches thick overlaying it. A backscatter density test on the top of the mat (right scale) yielded a result of 138.5 PCF. A line is then drawn from 130 PCF on the left scale through the intersection of 1.2 inches (bottom) and 138.5 PCF (right) and extended to the right. The correct density for the top layer is then read from the nomograph as 144.5 PCF on the right scale.

e.3. Number of readings: 3 one-minute readings are taken at a single location and are averaged to give a nuclear reading for that location.

g. CALCULATION

The wet density reading is divided by the three (3) point moving average of the unit weight of concrete and multiplied by 100 to obtain a percent density. When fewer than three (3) unit weights are available, the "Density Standard" shall be the average of those determinations made until a total of three (3) may be averaged.